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	First Named Inventor	Goguen	
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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Goguen et al.

Examiner: Baran

Serial No.: 09/642,267

Art Unit: 2857

Filed: August 18, 2000

For: Output Performance Trends of a Mass Storage System

CERTIFICATE UNDER 37 C.F.R. § 1.8(a)

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RESPONSE TO OFFICE ACTION

In the Office Action dated September 24, 2003, the Examiner maintained the rejections of the claims set forth in the prior office action, namely (1) Claims 1, 2 and 5-9 were rejected under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,623,598 issued to Voigt et al. ("Voigt") in view of U.S. Patent No. 6,128,717 issued to Harrison et al. ("Harrison"), and (2) Claims 3 and 4 were rejected under § 103(a) as being unpatentable over Voigt in view of Harrison and further in view of U.S. Patent No. 5,586,059 issued to Oshelski et al. ("Okhelski"). Reconsideration and allowance of the application are requested.

I. Background

A. Presenting Mass Storage System Performance in General

The present invention is directed to a method of presenting system performance to a user in a mass storage system having multiple disk drive storage elements controlled by a disk drive controller. During operation, the disk drive controller receives commands and data from and returns data to multiple host computers. To determine how well the system is performing, the host computers can be operated to test the controller and the disk drive elements. Accordingly, potential problems that can create bottlenecks on communication lines connected from the controller to either the disk drive elements or the hosts can be identified.

As noted in the specification on page 1, it is well known in the field to measure, typically using a single parameter, the instantaneous or average response time of a system. Typically, a host computer outputs one or more I/O requests to the disk drive controller, and then measures the time for a response to be received from the disk drive controller. This time duration, while representative of the response of a specific read or write command to the disk drive system, is most often not representative of the actual performance that can be obtained from the system.

B. Problems in Systems Having Multiple Host Computers

The performance of a large storage system is particularly difficult to measure since there are multiple host computers, which connect to the disk drive controllers, and which can operate at the same time in serial or parallel fashion. As a result, a plurality disk drive elements, usually arranged in a disk drive array, operating in either an independent fashion, a RAID configuration, or a mirrored configuration, e.g., can have a significant yet undetectable bandwidth or operational problems that cannot be addressed or discovered when commands are sent only from a single host computer. The present application addresses this problem by executing at a plurality of the host computers a test request by sending commands to the mass storage system, and

accumulating, at the executing host computers, data regarding performance of the mass storage system, in response to the requests sent by the host computers.

C. Independent Claim 1

Claim 1 is directed to a method for presenting system performance to a user in a mass storage system. The storage system has a plurality of disk drive storage elements controlled by a disk drive controller. The controller receives commands and data from and returns at least data to a plurality of host computers. The method features the steps of: (1) executing at a plurality of the host computers a test request by sending commands to the mass storage system, (2) accumulating, at the executing host computers, data regarding performance of the mass storage system, in response to the requests sent by the host computers, and (3) presenting the accumulated data, in a graphical plot format, for enabling the visualization of trends in the performance of the mass storage system as a function of at least one selected parameter, in response to the host generated commands.

D. Claim Rejections

The Examiner rejected Claims 1, 2 and 5-9 under 35 U.S.C. §103(a) as being obvious over Voigt in view of Harrison. The Examiner contends that Voigt discloses all the limitations of independent Claim 1 except for a controller connected to a plurality of host computers. The Examiner states that Harrison discloses a controller (interface structure 14) which is connected to a plurality of host computers (i.e., network environment). These rejections are respectfully traversed.

II. Harrison and Voigt Are Not Properly Combinable Under §103

Under §103, teachings of prior art references can be combined only if there is some suggestion or incentive to do so. The Harrison and Voigt references are not properly combinable because neither reference provides any suggestion or incentive for the combination.

A. Voigt Does Not Suggest Multiple Host Computers

Voigt, the primary reference, discloses a system for identifying methods of improving performance in a data storage system having a single host computer station connected to a data storage system having an array of storage disks. Voigt discloses selecting a performance metric (such as total number of blocks read or written by the host) to be measured during operation of the data storage system. Voigt then samples the performance metric during operation of the data storage system either in the data storage system 14 or in the single host computer station 12. (columns 5-6).

Voigt does not disclose or in any way suggest a disk drive controller receiving commands and data from and returning at least data to a plurality of host computers. Furthermore, Voigt does not disclose or in any way suggest (1) executing at a plurality of host computers a test request by sending commands to the mass storage system, or (2) accumulating, at the executing host computers, data regarding performance of the mass storage system in response to the requests sent by the host computers.

As previously noted, there are significant performance issues (e.g., undetectable bandwidth or operational problems) existing in systems with multiple host computers that cannot be addressed or discovered when commands are sent only from a single host computer. As Voigt only has a single host computer, it does not face or recognize these problems, much less provide any sort of solution. One skilled in the art reading this reference would find no suggestion or incentive for adding a plurality of host computers in Voigt and, much less of executing a test request at the plurality of host computers, or accumulating, at the executing host computers, data regarding performance of the mass storage system.

B. Harrison Does Not Suggest Combination With Voigt

The Examiner cited Harrison for disclosing a controller connected to a plurality of host computers. Harrison discloses a method of recording data onto a disk drive by categorizing the data into data types. Harrison is not directed to solving or even

recognizes the problem of determining or presenting system performance to a user of a mass storage system. Furthermore, Harrison is not concerned with the problems associated with measuring performance using even a single host computer, much less of multiple host computers.

In the Office Action, the Examiner again only refers to col. 5, lines 46-53 of Harrison for supposedly teaching that “providing performance data for a plurality of hosts can enhance the overall performance of a storage system.” The Examiner concludes that it would therefore be obvious to add Harrison’s plurality of host computers to the teaching of Voigt.

The cited portion of Harrison states as follows:

A more specific object of the present invention is to enhance the performance of a hard disk drive by providing a novel internal data object analysis process which analyzes data objects being sent to the disk drive from a host or hosts and stores the data objects at storage locations of the disk drive which provide appropriate access performance, depending upon determined particular types of the data objects. (emphasis added)

This cited passage of Harrison only discloses some type of internal data object analysis process that analyzes data objects being sent to a disk drive from hosts and stores the data objects at particular storage locations of the disk drive to provide “access performance” depending on the type of data object. This does not in any way relate to (1) executing at a plurality of host computers a test request by sending commands to the mass storage system, or (2) accumulating, at the executing host computers, data regarding performance of the mass storage system in response to the requests sent by the host computers. There are no test requests from host computers, and there is no accumulation of data regarding performance of the storage system in response to the requests, much less accumulation of performance data at the host computers. In fact, it is unclear whether there is any data on performance in Harrison.

The “access performance” mentioned by Harrison is apparently some level of performance resulting from storing data objects in particular locations based on the type of object stored.

This access performance is not in any way related to the presence of a plurality of host computers instead of a single host computer. In fact, the cited passage explicitly states that data can be sent from a single host or multiple hosts. Harrison’s access performance does not require and is not the result of having multiple hosts. There is no stated added benefit to using multiple hosts as opposed to a single host. Accordingly, one skilled in the art reading this reference would have no reason to even consider adding multiple hosts to any system.

The above cited passage therefore cannot be said to teach that providing performance data for a plurality of hosts can enhance the overall performance of a storage system. With respect to Harrison, the Examiner is asked, at the least, to explain (1) what performance data is collected by Harrison, (2) how Harrison teaches that this performance data relates to multiple hosts as opposed to a single host, and (3) how the reference teaches that the data would enhance the overall performance of a storage system.

Furthermore, there is nothing in Voigt that even remotely suggests the desirability or any need of organizing stored data objects in accordance with their types. Therefore, there is no basis to state that one skilled in the art would consider Harrison’s teaching of a plurality of host computers to somehow improve Voigt’s system performance.

Voigt and Harrison are simply not combinable in the manner suggested by the Examiner. Combining these references is a pure hindsight reconstruction of the claimed invention. Courts have repeatedly held such hindsight reconstruction to be impermissible. The mere assertion that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the

desirability of the combination. In the present application, the prior art provides no teaching, suggestion or motivation to combine the performance improvement system of Voigt with the data recording and categorizing system of Harrison. Furthermore, neither reference recognizes the problems solved by the present invention, much less provides any solution. As a result, there would have been no motivation whatsoever to combine Harrison with Voigt. The combination of these references is thus wholly improper and fails to make a prima facie showing of obviousness.

III. Even If Combined, Harrison and Voigt Do Not Teach The Claimed Invention

Even assuming, for the sake of argument, that Voigt and Harrison are properly combined under § 103, the combination does not disclose each and every element of the claims. The Examiner states that Voigt discloses executing at a single host computer a test request by sending commands to a mass storage system, and accumulating at the single host computer data regarding performance of the mass storage system. The Examiner further states that Harrison teaches a plurality of host computers connected to some interface structure, and that one could combine the teachings of the references. As noted above, Harrison, however, does not disclose either (1) executing at a plurality of host computers a test request by sending commands to the mass storage system, or (2) accumulating, at the executing host computers, data regarding performance of the mass storage system in response to the requests sent by the host computers. Harrison simply discloses, as the Examiner contends, a plurality of host computers connected to an interface structure. Thus, if Harrison were combined with Voigt as suggested by the Examiner, there would, at best, be a plurality of host computers, one of which would be Voigt's host computer, which would be the only computer executing a test request and accumulating performance data thereat. The other hosts would not be performing these functions. The claims would be distinguishable from this combination teaching because the claims require (1) executing at a plurality of host computers a test request by sending commands to the mass storage system, or (2) accumulating, at the executing host computers, data regarding performance of the mass storage system in response to

the requests sent by the host computers. Since each and every element of the claims is not disclosed by this combination of references, the rejection fails under § 103, and should be withdrawn.

The Office Action fails to respond to Applicants' position as set forth above and similarly in Applicants' Response to Advisory Action that the combination of Voigt and Harrison, even assuming if proper, would not teach all the elements of the claimed invention.

The remaining claims in the application are all dependent on Claim 1 and are also allowable over the Voigt and Harrison references.

Claims 1-9 are pending in the present application. As the application is now believed to be in condition for allowance, issuance of a Notice of Allowance is respectfully requested.

Respectfully submitted,



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